NOTES AND EXTRACTS.

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Aqueous Vapor in Relation to Perpetual Snow: by James Croll, LL.D., F. R. S.—Some twelve year ago I gave (Phil. Mag., March, 1867, Climate and Time, p. 548) what appears to be the true explanation of that apparently paradoxical fact observed by Mr. Glaisher that the difference of reading, between a thermometer exposed to direct sunshine and one shaded, *diminishes* instead of increases, as we ascend in the atmosphere. This led me to an important conclusion in regard to the influence of aqueous vapor on the melting of snow, but recent objections to some of my views convince me that I have not given to that conclusion the prominence it deserves. I shall now state in a few words the conclusion to which I refer.

The reason why snow at great elevations does not melt but remains permanent, is owing to the fact that the heat received from the sun is thrown off into stellar space so rapidly by radiation and reflection that the sun fails to raise the temperature of the snow to the melting point; the snow evaporates but does not melt. The summits of the Himalayas, for example, must receive more than ten times the amount of heat necessary to melt all the snow that falls on them, notwithstanding which the snow is not melted. And in spite of the strength of the sun and the dryness of the air at these altitudes, evaporation is insufficient to remove the snow. At low elevations, where the snow-fall is probably greater, and the amount of heat received even less than at the summits the snow melts and disappears. This, I believe, we must attribute to the influence of aqueous vapor. At high elevations the air is dry and allows the heat radiated from the snow to pass into space, but at low elevations a very considerable amount of heat radiated from the snow is absorbed by the aqueous vapor which it encounters in passing through the atmosphere. A considerable portion of the heat thus radiated being of the same quality as that which the snow itself radiates, is on this account absorbed by the snow. Little or none of it is reflected like that received from the sun. The consequence is that the heat thus absorbed accumulates in the snow till melting takes place. Were the amount of aqueous vapor possessed by the atmosphere sufficiently diminished, perpetual snow would cover our globe down to the sea-shore. It is true that the air is warmer at the lower level than at the higher level and by contact with the snow must tend to melt it more at the former than at the latter position. But we must remember that the air is warmer mainly in consequence of the influence of aqueous vapor, and that were the quantity of vapor reduced to the amount in question, the difference of temperature at the two positions would not be great.

But it may be urged as a further objection to the foregoing conclusion, that as a matter of fact on great mountain-chains, the line reaches to a lower level on the side where the air is moist than on the opposite side where it is dry and arid. As, for example, on the southern side of the Himalayas and on the eastern side of the Andes where the snow-line descends some 2,000 or 3,000 feet below that of the opposite, or dry side. But this is owing to the fact that it is on the moist side that by far the greatest amount of snow is precipitated. The moist winds of the SW. monsoon deposit their snow almost wholly on the southern side of the Himalayas, and the SE. trades, the snow on the east side of the Andes. Were the conditions in every respect the same on both sides of the mountain ranges with the exception only that the air on one was perfectly dry, allowing radiation from the snow to pass without interruption into stellar space, while on the other side the air was moist and full of aqueous vapor, absorbing the heat radiated from the snow, the snow-line would, in this case, undoubtedly descend to a lower level on the dry than on the moist side. No doubt more snow would be evaporated off the dry than off the moist side, but melting would certainly take place at a greater elevation on the moist than on the dry side, and this is what would mainly determine the position of the snow-line. * * * * * *

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